GLOBALSAT GPS Module

Hardware Data Sheet

Product No : ER-506

User Manual Version 1.1

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Product Description

Product Description

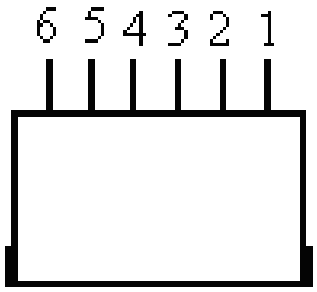
ER-506 GPS module features high sensitivity, low power and ultra small form factor. This GPS module is powered by SiRF Star IV, it can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment. With SiRF CGEE (Client Generated Extended Ephemeris) technology, it predicts satellite positions for up to 3 days and delivers CGEE-start time of less than 15 seconds under most conditions, without any network assistance. Besides, MicroPower Mode allows GPS module to stay in a hot-start condition nearly continuously while consuming very little power. ER-506 is suitable for the following applications:

- Automotive navigation
- Fleet management
- Marine navigation

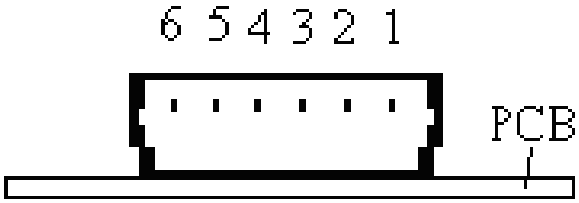
Product Features

- SiRF Star IV high performance GPS Chipset
- Very high sensitivity (Tracking Sensitivity: -163 dBm)
- Extremely fast TTFF (Time To First Fix) at low signal level
- Support RS-232 interface.
- Built-in LNA(with in CHIP)
- Compact size (30.0mm x 30.0 mm x 10.7mm) suitable for space-sensitive application
- Support NMEA 0183 V3.0 (GGA, GSA, GSV, RMC, VTG, GLL, ZDA)
- Support OSP protocol
- Support SBAS (WASS, EGNOS, MSAS, GAGAN)

Product Pin Description



1 : GND
2 : VIN
3 : RX
4 : TX
5 : GND
6 : Directive



PIN Number(s)	Name	Type	Description	Note
1,5	GND	P	Ground.	
2	VIN	P	This is the main power supply to the engine board. (4.5Vdc to 6.5Vdc)	
3	RXD	I	This is the main receive channel for receiving software commands to the engine board from SiRFdemo software or from user written software. Baud rate based on flash memory setting.	
4	TXD	O	This is the main transmits channel for outputting navigation and measurement data to user's navigation software or user written software.	
6	Directive	O	This pin indicates the GPS states.	

Electrical Specification

Absolute Maximums Ratings

Parameter	Min.	Typ.	Max.	Conditions	Unit
POWER Supply					
Main power supply(VCC)	4.5	5.0	6.5		V
Main power supply Current	45	50	55	GPS is not 3D Fixed.	mA
	33	34	38	GPS is 3D Fixed.	mA
RF					
Input Impendance		50			Ω
Operating Frequency		1.575			Ghz

DC Electrical characteristics

Parameter	Symbol	Min.	Typ.	Max.	Conditions	Units
Directive Low Level Output Voltage	V_{OL}			0.4		V
Directive High Level Output Voltage	V_{OH}		3.3			V
RS-232 Low Level Output Voltage	V_{IL}		-6			V
RS-232 High Level Output Voltage	V_{IH}		6			V

Receiver Performance

Sensitivity	Tracking : Autonomous acquisition :	-163dBm -160 dBm
Time-To-First-Fix[1]	Cold Start – Autonomous	< 35s
		<15s (with CGEE)
	Warm Start – Autonomous[2]	< 35s
		< 15s(with CGEE)
	Hot Start – Autonomous[3]	< 1s
Horizontal Position Accuracy[4]	Autonomous	< 2.5m
Velocity Accuracy[5]	Speed Heading	< 0.01 m/s < 0.01 degrees
Reacquisition	0.1 second, average	
Update Rate	1 Sec / 5 Sec	
Maximum Altitude	< 18,000 meter	
Maximum Velocity	< 515 meter/ second	
Maximum Acceleration	< 4G	

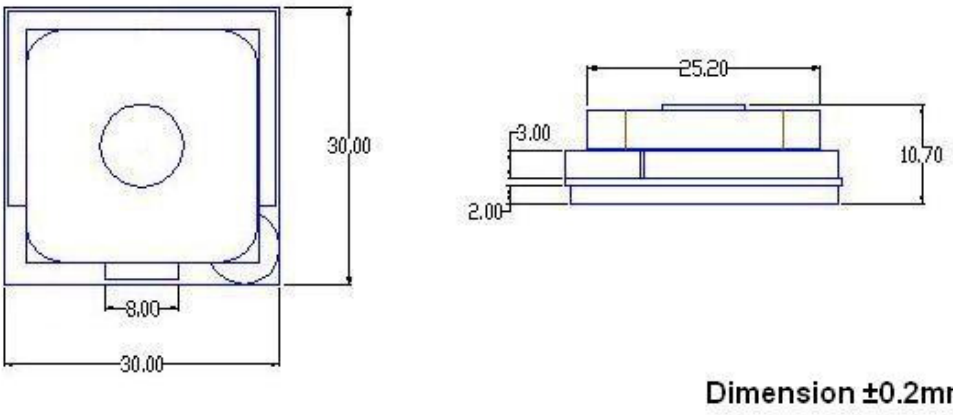
<Note>

1. 50% -130dBm Fu 0.5ppm Tu ±2s Pu 30Km
2. Commanded **Warm START**
3. Commanded **Hot START**
4. 50% 24hr static, -130dBm
5. 50% @ 30m/s

Environmental Characteristics

Parameter	Min	Typ	Max	Unit
Humidity Range	5		95	% non-condensing
Operation Temperature	-40	25	85	℃
Storage Temperature	-40		85	℃

Physical Characteristic



Dimension ±0.2mm

OPERATING Description

GND

This is Ground pin for the baseband circuit.

VIN

This is the main power supply to the engine board. (4.5Vdc to 6.5Vdc)

RXD

This is the main channel for receiving software commands from SiRFdemo software or from your proprietary software.

TXD

This is the main transmits channel for outputting navigation and measurement data to user's navigation software or user written software.

Directive

This pin exports signal to indicate the GPS states.
GPS unfix: always low level.
GPS fixed: one second high level, one second low level.

LED

LED indicator for GPS fix or not fix

LEDOFF:	Receiver switch off
LED ON:	No fixed, Signal searching
LED Flashing:	Position Fixed

SOFTWARE COMMAND

NMEA Output Command

GGA - Global Positioning System Fixed Data

Note – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description

Table B-2 contains the values for the following example:

$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,-34.2,M,,0000*18

Table B-2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table B-3
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation[1]	-34.2	meters	Geoid-to-ellipsoid separation. Ellipsoid altitude=MSL Altitude + Geoid Separation
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR><LF>			End of message termination

Table B-3 Position Fix Indicator

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode , fix valid
3	Not supported
6	*Dead Reckoning Mode, fix valid*

Note:

A valid status is derived from all the parameters set in the software. This includes the minimum

number of satellites required, any DOP mask setting, presence of DGPS corrections, etc. If the default or current software setting requires that a factor is met, then if that factor is not met the solution will be marked as invalid.

GLL - Geographic Position-Latitude/Longitude

Note – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description

Table B-4 contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A,A*41

Table B-4 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	n		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	*A*		*A=Autonomous, D=DGPS,* *E=DR* *N=Output Data Not Valid* *R= Coarse Position*[1] *S=Simulator*
Checksum	*41		
<CR><LF>			End of message termination

1. Position was calculated based on one or more of the SVs having their states derived from almanac parameters, as opposed to ephemerides.

GSA - GNSS DOP and Active Satellites

Table B-5 contains the values for the following example:

$GPGSA,A,3,07,02,26,27,09,04,15,,,,,,1.8,1.0,1.5*33

Table B-5 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table B-6
Mode 2	3		See Table B-7
Satellite Used[1]	07		Sv on Channel 1
Satellite Used[1]	02		Sv on Channel 2
…..			
Satellite Used[1]			Sv on Channel 12
PDOP[2]	1.8		Position dilution of Precision
HDOP[2]	1.0		Horizontal dilution of Precision
VDOP[2]	1.5		Vertical dilution of Precision
Checksum	*33		
<CR><LF>			End of message termination

1. Satellite used in solution.
2. Maximum DOP value reported is 50. When 50 is reported, the actual DOP may be much larger.

Table B-6 Mode1

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	2Dautomatic-allowed to automatically switch 2

Table B-7 Mode 2

Value	Description
1	Fix Not Available
2	2D (<4 SVs used)
3	3D (>3 SVs used)

GSV - GNSS Satellites in View

Table B-8 contains the values for the following example:

$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71

$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41

Table B-8 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 to 3
Message Number[1]	1		Range 1 to 3
Satellites in View[1]	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum90)
Azimuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR(C/No)	42	dBHz	Range 0 to 99,null when not tracking
…….			…….
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	Degrees	Channel 4(Maximum90)
Azimuth	138	Degrees	Channel 4(True, Range 0 to 359)
SNR(C/No)	42	dBHz	Range 0 to 99,null when not tracking
Checksum	*71		
<CR><LF>			End of message termination

1. Depending on the number of satellites tracked, multiple messages of GSV data may be required. In some software versions, the maximum number of satellites reported as visible is limited to 12, even though more may be visible.

RMC - Recommended Minimum Specific GNSS Data

Note – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description

Table B-9 contains the values for the following example:

$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598,,,A*10

Table B-9 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status[1]	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation[2]		degrees	E=east or W=west
East/West Indicator[2]	E		E=east
Mode	*A*		*A=Autonomous, D=DGPS,* *E=DR* *N=Output Data Not Valid* *R= Coarse Position[3]* *S=Simulator*
Checksum	*10		
<CR><LF>			End of message termination

1. A valid status is derived from all the parameters set in the software. This includes the minimum number of satellites required, any DOP mask setting, presence of DGPS corrections, etc. If the default or current software setting requires that a factor is met, then if that factor is not met the solution will be marked as invalid.
2. SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions relative to true North.
3. Position was calculated based on one or more of the SVs having their states derived from almanac parameters, as opposed to ephemerides.

VTG - Course Over Ground and Ground Speed

Note – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description

Table B-10 contains the values for the following example:

$GPVTG,309.62,T,,M,0.13,N,0.2,K,A*23

Table B-10 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic[1]
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	*A*		*A=Autonomous, D=DGPS,* *E=DR* *N=Output Data Not Valid* *R= Coarse Position[2]* *S=Simulator*
Checksum	*23		
<CR><LF>			End of message termination

1. SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.
2. Position was calculated based on one or more of the SVs having their states derived from almanac parameters, as opposed to ephemerides.

ZDA - Time and Date

This message is included only with systems which support a time-mark output pulse identified as "1PPS". Outputs the time associated with the current 1PPS pulse. Each message is output within a few hundred ms after the 1PPS pulse is output and tells the time of the pulse that just occurred.

Table B-11 contains the values for the following example:

$GPZDA,181813,14,10,2003,,*4F<CR><LF>

Table B-11: ZDA Data Format

Name	Example	Unit	Description
Message ID	$GPZDA		ZDA protocol header
UTC Time	181813	hhmmss	The UTC time units are: hh=UTC hours from 00 to 23 mm=UTC minutes from 00 to 59 ss=UTC seconds from 00 to 59 Either using valid IONO/UTC or estimated from default leap seconds
Day	14		Day of the month, range 1 to 31
Month	10		Month of the year, range 1 to 12
Year	2003		Year
Local zone hour[1]		hour	Offset from UTC (set to 00)
Local zone minutes[1]		minute	Offset from UTC (set to 00)
Checksum	*4F		
<CR><LF>			End of message termination

1. Not supported by CSR, reported as 00.

NMEA Input Command

A). Set Serial Port ID: 100 Set PORTA parameters and protocol

This command message is used to set the protocol (SiRF Binary, NMEA, or USER1) and/or the communication parameters (baud, data bits, stop bits, parity). Generally, this command would be used to switch the module back to SiRF Binary protocol mode where a more extensive command message set is available. For example, to change navigation parameters. When a valid message is received, the parameters will be stored in battery backed SRAM and then the receiver will restart using the saved parameters.

Format:

$PSRF100,<protocol>,<baud>,<DataBits>,<StopBits>,<Parity>*CKSUM<CR><LF>

<protocol>	0=SiRF Binary, 1=NMEA, 4=USER1
<baud>	1200, 2400, 4800, 9600, 19200, 38400
<DataBits>	8,7. Note that SiRF protocol is only valid f8 Data bits
<StopBits>	0,1
<Parity>	0=None, 1=Odd, 2=Even

Example 1: Switch to SiRF Binary protocol at 9600,8,N,1

$PSRF100,0,9600,8,1,0*0C<CR><LF>

Example 2: Switch to User1 protocol at 38400,8,N,1

$PSRF100,4,38400,8,1,0*38<CR><LF>

**Checksum Field: The absolute value calculated by exclusive-OR the 8 data bits of each character in the Sentence, between, but excluding “$” and “*”. The hexadecimal value of the most significant and least significant 4 bits of the result are convertted to two ASCII characters (0-9, A-F) for transmission. The most significant character is transmitted first.

**<CR><LF> : Hex 0D 0A

B). Navigation Initialization ID：101 Parameters required for start

This command is used to initialize the module for a warm start, by providing current position（in X, Y, Z coordinates）,clock offset, and time. This enables the receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters will enable the receiver to acquire signals more quickly, and thus, produce a faster navigational solution.

When a valid Navigation Initialization command is received, the receiver will restart using the input parameters as a basis for satellite selection and acquisition.

Format：

$PSRF101,<X>,<Y>,<Z>,<ClkOffset>,<TimeOfWeek>,<WeekNo>,<chnlCount>,<ResetCfg>*CKSUM<CR><LF>

<X>	X coordinate position INT32
<Y>	Y coordinate position INT32
<Z>	Z coordinate position INT32
<ClkOffset>	Clock offset of the receiver in Hz, Use 0 for last saved value if available. If this is unavailable, a default value of 75000 for GSP1, 95000 for GSP 1/LX will be used. INT32
<TimeOf Week>	GPS Time Of Week UINT32
<WeekNo>	GPS Week Number UINT16 （ Week No and Time Of Week calculation from UTC time）
<chnlCount>	Number of channels to use.1-12. If your CPU throughput is not high enough, you could decrease needed throughput by reducing the number of active channels UBYTE
<ResetCfg>	bit mask 0×01=Data Valid warm/hot start=1 0×02=clear ephemeris warm start=1 0×04=clear memory. Cold start=1 UBYTE

Example: Start using known position and time.

$ PSRF101,-2686700,-4304200,3851624,96000,497260,921,12,3*7F

C). Set DGPS Port ID: 102 Set PORT B parameters for DGPS input

This command is used to control Serial Port B that is an input only serial port used to receive RTCM differential corrections.

Differential receivers may output corrections using different communication parameters. The default communication parameters for PORT B are 9600Baud, 8data bits, 0 stop bits, and no parity. If a DGPS receiver is used which has different communication parameters, use this command to allow the receiver to correctly decode the data. When a valid message is received, the parameters will be stored in battery backed SRAM and then the receiver will restart using the saved parameters.

Format:

$ PSRF102,<Baud>,<DataBits>,<StopBits>,<Parity>*CKSUM<CR><LF>

<baud>	1200,2400,4800,9600,19200,38400
<DataBits>	8
<StopBits>	0,1
<Parity>	0=None, Odd=1,Even=2

Example: Set DGPS Port to be 9600,8,N,1

$ PSRF102,9600,8,1.0*12

D). Query/Rate Control ID: 103 Query standard NMEA message and/or set output rate

This command is used to control the output of standard NMEA message GGA, GLL, GSA, GSV, RMC, VTG. Using this command message, standard NMEA message may be polled once, or setup for periodic output. Checksums may also be enabled or disabled depending on the needs of the receiving program. NMEA message settings are saved in battery backed memory for each entry when the message is accepted.

Format:

$ PSRF103,<msg>,<mode>,<rate>,<cksumEnable>*CKSUM<CR><LF>

<msg>	0=GGA, 1=GLL, 2=GSA, 3=GSV, 4=RMC, 5=VTG 6=MSS(if internal beacon is supported) 7=Not defined 8=ZDA(if 1PPS output supported) 9=Not defined
<mode>	0=SetRate 1=Query 2=ABP On 3=ABP Off
<rate>	Output every <rate>seconds, off=0,max=255
<cksumEnable>	0=disable Checksum,1=Enable checksum for specified message

Example 1: Query the GGA message with checksum enabled

$ PSRF103,00,01,00,01*25

Example 2: Enable VTG message for a 1Hz constant output with checksum enabled

$ PSRF103,05,00,01,01*20

Example 3: Disable VTG message

$ PSRF103,05,00,00,01*21

E). LLA Navigation Initialization ID: 104 Parameters required to start using Lat/Lon/Alt

This command is used to initialize the module for a warm start, by providing current position (in Latitude, Longitude, Altitude coordinates), clock offset, and time. This enables the receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters will enable the receiver to acquire signals more quickly, and thus, will produce a faster navigational soution.

When a valid LLA Navigation Initialization command is received, the receiver will restart using the input parameters as a basis for satellite selection and acquisition.

Format:

$ PSRF104,<Lat>,<Lon>,<Alt>,<ClkOffset>,<TimeOfWeek>,<WeekNo>,<ChannelCount>,<ResetCfg>*CKSUM<CR><LF>

<Lat>	Latitude position, assumed positive north of equator and negative south of equator float, possibly signed
<Lon>	Longitude position, it is assumed positive east of Greenwich and negative west of Greenwich Float, possibly signed
<Alt>	Altitude position float, possibly signed
<ClkOffset>	Clock Offset of the receiver in Hz, use 0 for last saved value if available. If this is unavailable, a default value of 75000 for GSP1, 95000 for GSP1/LX will be used. INT32
<TimeOfWeek>	GPS Time Of Week UINT32
<WeekNo>	GPS Week Number UINT16
<ChannelCount>	Number of channels to use. 1-12 UBYTE
<ResetCfg>	bit mask 0×01=Data Valid warm/hot starts=1 0×02=clear ephemeris warm start=1 0×04=clear memory. Cold start=1 UBYTE

Example: Start using known position and time.

$ PSRF104,37.3875111,-121.97232,0,96000,237759,922,12,3*37

F). Development Data On/Off ID: 105 Switch Development Data Messages On/Off

Use this command to enable development debug information if you are having trouble getting commands accepted. Invalid commands will generate debug information that should enable the user to determine the source of the command rejection. Common reasons for input command rejection are invalid checksum or parameter out of specified range. This setting is not preserved across a module reset.

Format: $PSRF105,<debug>*CKSUM<CR><LF>

<debug> 0=Off, 1=On

Example: Debug On $PSRF105,1*3E

Example: Debug Off $PSRF105,0*3F

G). Select Datum ID: 106 Selection of datum to be used for coordinate Transformations

GPS receivers perform initial position and velocity calculations using an earth-centered earth-fixed (ECEF) coordinate system. Results may be converted to an earth model (geoid) defined by the selected datum. The default datum is WGS 84 (World Geodetic System 1984) which provides a worldwide common grid system that may be translated into local coordinate systems or map datums. (Local map datums are a best fit to the local shape of the earth and not valid worldwide.)

Examples:

Datum select TOKYO_MEAN

$PSRF106,178*32

Name	Example	Unit	Description
Message ID	$PSRF106		PSRF106 protocol header
Datum	178		21=WGS84 178=TOKYO_MEAN 179=TOKYO_JAPAN 180=TOKYO_KOREA 181=TOKYO_OKINAWA Debug
Checksum	*32		
<CR><LF>			End of message termination

RoHS / Lead Free Compliance

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RoHS / Lead Free Compliance

Dear Sales:

This letter is intended to answer questions you may come across regarding the compliance of Globalsat WorldCom Corporation products with the following European Directive 2011/65/EU （RoHS）:

- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment （RoHS）.

This Directive aim is to avoid or limit the use of hazardous material compliant and meet the Standard by July.16,2011 of less than "0.1% by weight per homogeneous material for lead,hexavalent chromium,mercury, PBB and PBDE and 0.01% by weight and per homogeneous material for cadmium".

Globalsat has incorporated the requirement of 2011/65/EU into the product / technology development roadmaps and is committed to make lead free / RoHS fully compliant product available for shipment by July.16,2011.

Kevin Tan
Quality Assurance Manager

Prince Cheng
Chief Executive Officer（CEO）

QR8204-02A

Reversion history

Reversion	Date	Name	Status / Comments
V1.0	20130925	Mason	Initial Version
V1.1	20131008	Mason	Modify pin 1PPS to Directive